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WATER AND REGIONAL STABILITY: THE NILE A CASE STUDY

BY

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ABSTRACT

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Water is crucial for personal survival and for national health and economic growth. This paper examines how water impacts the stability of the countries within the Nile River Basin. These ten countries are connected by this body of water. All of these countries receive some water in the form of rainfall. Some of these countries such as Burundi and Ethiopia receive more than enough water to meet their current needs and add water to the river system. Other countries such as Egypt and Sudan receive so little rainfall that they must rely upon the waters of the Nile to sustain their agriculture, industry, and communities. This paper examines the political history, international water law, treaties, water management plans, demographics, and the per capita gross domestic product of the nations in the Nile River Basin to determine how current policies and practices contribute to the stability of this region of Africa. It also suggests steps that will help sustain that stability through changes in population(s), economy, and the environment.

WATER AND REGIONAL STABILITY: THE NILE A CASE STUDY

> "…Water represents one of the great diplomatic and development opportunities of our time. It's not every day you find an issue where effective diplomacy and development will allow you to save millions of lives, feed the hungry, empower women, advance our national security interests, protect the environment, and demonstrate to billions of people that the United States cares, cares about you and your welfare. Water is that issue…."
>
> —Hillary Rodham Clinton
> Secretary of State

Water's Importance

Secretary Clinton, in her remarks to Congress, eloquently described many of the reasons why the United States views water as strategically important[1]. The 2010 report on the State Department and United States Agency for International Development's (USAID) progress on implementing the Paul Simon Water for the Poor Act shows the level of commitment our legislators have to improving water and sanitation access around the globe. The Water for the Poor Act is part of the US effort to help build and sustain democratic, well-governed states that respond to the needs of their people, act to reduce widespread poverty, seek to cooperate with neighboring countries, and conduct themselves responsibly in the international system. Water can be a vital part of creating a stable and prospering economy and nation. Because of its importance to all people, anything that threatens a country's water supply poses a grave threat. This paper examines the Nile River Basin in Africa to determine whether the treaties, regulation, and management of the water resource shared by ten countries contribute to the political stability of North Eastern Africa.

The following facts support the US approach as outlined in the Water Act for the Poor. According to the United Nations, 1.1 billion people in developing countries have

inadequate access to water and 2.6 billion people lack basic sanitation.[2] The impact to the health and economic growth are substantial. Each year 1.8 million children die from diarrhea caused by waterborne diseases.[3] Lack of access to clean water and sanitation across Sub-Saharan Africa cause loses of about 5% of Gross Domestic Product (GDP) or some $28.4 billion annually.[4] Investments in water and sanitation have the potential to generate a high return because every $1 spent on clean drinking water and sanitation creates, on average, $8 in reduced healthcare costs plus worker productivity gains. Beyond these immediate benefits, improved access to water and sanitation has the potential to generate long-run dynamic effects that will boost economic efficiency. Growing populations require sustainable food production. Agricultural water needs are best met through integrated water resource management practices. The economies of many developing nations are heavily dependent upon sustainable agriculture. Sharing best practices with farmers allow farmers to use water storage, irrigation, water re-cycling, fertilizing methods, crop selection, and other practices that create farming efficiencies and allow maximum food production with a minimum water usage. The Nile River Basin presents challenges to farmers and politicians alike in all of the nations within the watershed.

The Nile River Geography

The Nile River Basin is shared by ten riparian nations including Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. One of the world's longest rivers, the Nile, flows 6850 km from the Equatorial Lakes to the Mediterranean Sea.[5] The Nile River has two main tributaries, the White Nile and the Blue Nile. The White Nile starts in East Central Africa

Figure 1 – Nile River Basin

around Lake Victoria and the Equatorial Lakes flowing northwards through Uganda into Sudan. The Blue Nile starts in the Ethiopian Highlands and flows westwards into Sudan. The White Nile and Blue Nile meet in Khartoum, Sudan and continue flowing northwards into Egypt and the Mediterranean Sea. The White Nile is fed by waters from the Ruwenzori Mountains and the Equatorial Lakes, including Lake Victoria which is the largest lake in Africa covering 69,000 km^2. The White Nile contributes a small but steady flow of water, about 14 percent of the Nile's water. Rivers from Ethiopia provide 86 percent of the Nile flow. The Blue Nile provides 59 percent, the Baro-Akobo (Sobat) provides 14 percent, and the Tekeeze (Atbara) provides 13 percent.[6] During the rainy season between July and October, up to 90 percent of the Nile's water comes from Ethiopia. The northern end of the river is in an arid or semi-arid climate where it receives little or no water from rainfall. Due to the arid nature of the Nile's northern half, the river looses water to evaporation and seepage from the river into the ground. The amount of water discharged from the Nile River is much lower than rivers that have similar sized watershed areas. The Nile watershed area covers 3,110,000 $km^{2,}$ approximately 10% of Africa, and discharges 84 Billion Cubic Meters (BCM).[7] By comparison, the Mississippi River with a watershed area of 3,270,000 km^2 discharges 562 BCM.[8] Some of the countries within the Nile River Basin, such as the Democratic Republic of the Congo, have additional water resources. Other nations such as Egypt and Sudan are completely dependent upon the Nile River.

The Nile River Basin receives 1300 mm of rainfall annually. Table 1 shows the renewable water resources for each country within the Nile River Basin. It also shows what percent of each country is within the Nile Basin. Much of the rainfall in Burundi,

Rwanda, and Uganda feeds into Lake Victoria and the White Nile River. The rainfall in the Democratic Republic of Congo and some from Ethiopia flow into the White Nile as it winds its way from Lake Victoria down through the Lake Albert, and into the swamps in southern Sudan.

Country	Country Area (km2)	Area within Nile Basin (km2)	% of the total Nile Basin Area	% of the country in the Nile Basin	Internal Renewable Water Resources (IRWR) (km^3/year)	Actual Renewable Water Resources (ARWR) (km^3/year)	Dependency Ratio %	IRWR per Inhab. In 1994 (m^3/inhab)
Burundi	27,835	13,260	0.4	47.6	3.6	3.6	0.0	579
DR Congo	2,345,410	22,143	0.7	0.9	935.0	1,019.0	8.2	21,973
Egypt	1,001,450	326,751	10.5	32.6	1.7	58.3	96.9	29
Eritrea	121,320	24,921	0.8	20.5	2.8	8.8	68.2	815
Ethiopia	1,127,127	365,117	11.7	32.4	110.0	110.0	0.0	2,059
Kenya	582,650	46,229	1.5	7.9	20.2	30.2	33.1	739
Rwanda	26,340	19,876	0.7	75.5	6.3	6.3	0.0	883
Sudan	2,505,810	1,978,506	63.6	79.0	35.0	88.5	77.3	1,279
Tanzania	945,090	84,200	2.7	8.9	80.0	89.0	10.1	2,773
Uganda	236,040	231,366	7.4	98.0	39.2	66.0	40.9	1,891

Table 1.[9]

When creating a country or basin water policy and integrated water resources management plan, there are many factors that must be taken into consideration. One of the most basic factors is to understand annually how much recharge of water sources occurs through rainfall. The Internal Renewable Water Resources (IRWR) are the average annual natural inflow and runoff from rainfall that feed each hydrosystem (catchment area or aquifer).[10] Table 1 is important because it represents how much water use, in cubic kilometers per year, is sustainable over time. The column titled Actual Renewable Water Resources (ARWR) includes water that originates outside of the boarders of the country. For example, Egypt receives 1.7 km^3/year of rainwater and 56.6 km^3/year of water from the Nile River. The dependency ratio shows how dependent a given country is on water from outside its border. The table illustrates that

Egypt receives 97% of its water and Sudan 77% from sources outside of their national borders. The fact that such a large percent of the water they use comes from outside their borders makes them more dependent upon cooperation with other countries to ensure they receive the water they need. The dependency ratio of Ethiopia and Rwanda are 0% reflecting that both countries currently receive sufficient rainwater to meet needs.

Political History of Nile River Basin

During the 19th century Egypt became an important part of the trade route from Europe through Cairo and Suez to Bombay. As part of the Ottoman Empire, under Governor Mohammed Ali, the Egyptian part of the empire expanded to extend into Sudan and to the Euphrates River. Mohammed's grandson, Khedive Ismail, tried to gain control of the Nile Valley in Ethiopia and the Red Sea coast. Ismail attacked into Ethiopian territory and fought Ethiopian forces at Gundet in November 1875 and Gura in March 1876 where he lost badly in both battles.[11] This ended Egypt's expansionist ambitions and attempts to gain control over parts of Ethiopia which has been and remains a crucial piece of any comprehensive basin wide water management plan.

Egyptian financial collapse in 1875 caused the country to sell shares in the recently completed Suez Canal in an attempt to raise badly needed revenue. Britain, seeing a business opportunity, purchased controlling shares in the canal.[12] This purchase of Suez Canal shares started Britain's colonial influence over Egypt. Early treaties set limits or conditions on how upstream countries could use or make changes to river ways or surrounding lands. These treaties were negotiated by Britain on behalf of Egypt and Sudan with upstream countries. The main purpose of the treaties was to ensure a reliable flow of water to sustain the countries who relied upon the water for

survival. The treaties from 1891 through 1953 had European nations as signatories and guarantors of their African colonies. The following European countries negotiated on behalf of their colonial interests: Britain negotiated for Egypt and Sudan, Italy for the Horn of Africa via Eritrea and Ethiopia, and France and Belgium for Equatoria (present day southern Sudan and northern Uganda).

For thousands of years the river has carried sediment from upstream down to the arid and semi-arid plains of Sudan and Egypt. During the annual floods between July and October the river water saturated the flood plain covering it with fresh silt from the Ethiopian Highlands and flushing any salts from the soil surface down below the root zone.[13] For the farmers, problems occurred if the river level stayed too high for too long or did not rise to saturate the soil before the winter planting. These floods and droughts came with regularity limiting the land that would support farming and the amount of food that could be produced. By the late 1890's, agricultural production was being outstripped by the growth of the population in Egypt and the Sudan. Britain was also putting pressure on its colonies in Egypt and Sudan to grow cotton to help alleviate a relative shortage of cotton on the world market. Farming cotton required a consistent source of water, not the seasonal flooding and drying that Egypt's traditional farming methods had adapted to. To solve these problems, the Nile had to be controlled to reduce flooding and droughts, and to create agricultural stability along its banks. The need for summer irrigation water and flood control drove a period of water dam construction along the Nile, with Egypt and Sudan disputing whether the development ought to be further up-stream or down.[14] Harnessing the power of the Nile also provided hydroelectric power necessary for industry.

Between 1891 and 1994 there were nineteen treaties ratified related to the Nile River. Looking broadly at the treaties, here are the major issues covered: quantity of water (seven), hydropower (four), joint management (four), boarder issues or territory (three), and irrigation (one). The first Nile River treaty in 1891 between Britain and Italy limited any construction on the Atbara River (in present day Eritrea) that would impact the river's flow thereby protecting the agriculture in Egypt and Sudan that depended on the water.[15] The treaties that most significantly impact water use within the Nile River Basin include the treaties of May 1929 and November 1959. Many of the treaties seek to guarantee that Egypt and Sudan will have unfettered access to the waters of the Nile for purposes of irrigation and hydroelectric power. The 1929 treaty establishes that no riparian can make changes to the Nile, its tributaries, or lakes (especially those works related to irrigation or power generation) without Egypt's consent. The treaty grants Sudan water rights of 4 billion cubic meters (BCM) per year, Egypt is granted water rights of 48 BCM with 32 BCM not allocated.[16]

The first Aswan Dam was started in 1889 and completed in December 1902. Construction consisted of re-enforcing piers with sluice gates between to allow water through the Dam during the flood period. The Dam and others that followed it were built to help catch the annual flood waters for use in irrigation of crops. The dam gates were designed to be opened during the annual flood allowing the flood waters to pass through the dam carrying with them most of the silt carried by the river. The gates were gradually closed in the fall to capture water for irrigation use through the winter.

The height of the dam was raised in two phases, 1907–1912 and 1929–1933, to capture more water for irrigation and help control flood waters. Even with these

modifications, the first Aswan dam proved to have an inadequate reservoir area. During extreme flooding, the sluices of the dam were opened to relieve the water pressure against them, flooding the areas downstream. In 1946, the dam almost overflowed and rather than raising the dam a third time, it was decided that a second dam 6 kilometers to the south of the old one would be built.[17] In the early 1950s, designs began to be drawn for what was to become the High Dam at Aswan. In 1956, Sudan gained its independence. With independence, Sudan objected to Egypt's planned Aswan High Dam. When Sudan unilaterally withdrew from the 1929 treaty, Egypt sent its Army to the border in a show of force. In 1958, a military coup and new leadership caused Sudan to soften its opposition to the proposed dam. With the signing of the Nile Water Agreement by Egypt and Sudan in November of 1959, work began on the second Aswan dam. The Nile Waters Agreement increased the amount of water that Sudan is entitled to each year from 4 BCM to 18.5 BCM per year and Egypt's water right to from 48 BCM to 55.5 BCM. Ethiopia refused to recognize the agreement between Egypt and the Sudan on the division of the waters of the Nile. The 1959 treaty refers to "full utilization" and "full control of the river," when the waters of the Nile are divided between only two states. In an Aide Memoir of 23 September 1957, addressed to the diplomatic missions in Cairo, the Government of Ethiopia declared: "Ethiopia has the right and obligation to exploit its water resources, for the benefit of present and future generations of its citizens [and] must, therefore, reassert and reserve now and for the future, the right to take all such measures in respect of its water resources.[18] Ethiopia, a source of the majority of water in the Blue Nile, sought to assert its right and obligation to exploit its water resources to

benefit current and future generations. They wanted to preserve the right to utilize waters from the Nile River even as Egypt and Sudan sought to take it away from them[19].

The 1959 agreement cleared the way for Egypt to construct the Aswan High Dam. The Aswan High Dam was completed in 1970 at a cost of 850 million Egyptian Pounds. It is 111 m high and its reservoir, Lake Nassar, has a gross capacity of 169 BCM and caused the Nile River to widen for 320 km in Egypt and 160 km in Sudan. Twelve turbines within the dam generate 10 billion kilowatt hours of electricity annually with another 4 billion kilowatt hours generated by Aswan Reservoir Dams. Together, these sources of hydropower produced 11% of Egypt's electricity in 2008.[20] The dam reservoir supports a fishing fleet, and allows Egypt to use the waters of the Nile to irrigate an additional 70,000 acres of crops.[21]

Because Lake Nasser extends 150 kilometers into Sudanese territory, Sudan was paid 15 million Egyptian pounds in sterling as compensation for resettling as many as 50,000 from Wady Halfa who were displaced.[22] Sudan was permitted to construct two dams to divert some waters for irrigation purposes. In 1964, Sudan built the Khashm El Girba dam on the Atbara River with a storage capacity of 1.3 BCM and in 1966, completed Roseires dam on the Blue Nile with a storage capacity of 3.35 BCM.[23] Seeking a means to increase the flow of the Nile, both countries agreed to build a canal in southern Sudan between Jonglei and the mouth of the Sobat River on a cost sharing basis. The canal was designed to increase water in the Nile by bypassing the Sudd swamp, where much of the water evaporates or sinks into the ground. This effort known as the Jonglei Canal Scheme started construction in 1978. The project was designed to deliver an additional 4.7 BCM of water down the White Nile, water that normally is lost in

the Sudd area. When the project was planned, the benefits to Sudan included additional water for livestock, a roadway along the canal, reducing the period of annual flooding, and shortening the river route from Juba to Malakal (two provincial capitals) by about 300 kilometers.[24] During the project development, little regional input was sought. From a south Sudan prospective, the project was seen as benefitting the federal governments of Sudan and Egypt while harming those living in the Sudd region. Six years and 250 km later, the project was halted by southern Sudanese forces during the civil war. Opponents of the project point to the unknown environmental impact(s) and harm to the way of life for those living in the Sudd area as reasons why the project should not be re-started and finished.

Water Management in the Nile River Basin

Recent organizations established to help manage the waters of the Nile River basin include the Hydromet Survey (1967-1992) and Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE) (1992-1998) The Hydromet Survey was a mechanism for Riparians along the Nile River to receive technical assistance. TECCONILE provided a forum for members of government and each country's water resource managers to gather and discuss basin wide management of Nile river waters. TECCONILE produced the first Water Resource Atlas of the Nile River Basin in 1994.[25] The Atlas concentrated on water resources and water use. The use of remote sensing and geographic information system data made the atlas an excellent form to collect, update, and distribute information about the river basin. TECCONILE also conducted workshops in Entebbe and Cairo in 1994 to facilitate Nile riparian nations drafting a Nile River Basin Action Plan (NRBAP). The NRBAP includes planning and integrated management of water

resources; re-enforcement of the institutions and human resources; facilitation of basin-wide cooperation; and the environment's protection and improvement.[26]

In February 1999 TECCONILE was succeeded by the Nile Basin Initiative (NBI). The Nile Basin Initiative has continued to build upon many of the projects started by TECCONILE. All of the countries within the Nile River Basin have expressed a serious concern about the need for a collective dialogue and are working under a transitional arrangement while striving to develop a permanent legal framework. The shared vision of the members of the Nile Basin Initiative is, "To achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources."[27]

The partners in the Nile Basin Initiative worked through a series of steps and projects that were designed to foster trust and to help each nation analyze the ways in which they utilize the waters of the Nile and how their actions affect the other riparian nations. The programs included: Water Resources Management, Regional Power Trade, Applied Training, Confidence-Building and Stakeholder Involvement, Shared Vision Coordination, Socio-Economic and Benefits Sharing, Transboundary Environmental Action, and Efficient Water Use for Agriculture.[28] The Applied Training, Confidence-Building, Stakeholder Involvement, and Shared Vision Coordination programs were conducted to build trust and to educate many stakeholders in the NBI. These programs ran education programs and workshops to build a foundation of knowledge for national leaders, resource managers, scientists, and NGO stakeholders to prepare them for crafting the national water resource management policies and the Integrated Water Resource Management policy within each country. These programs

also provide an opportunity for all member countries to send policy makers, resource managers, and water infrastructure operators and scientists to receive education from universities, workshops, and basin-wide information sharing forums.

The Water Resource Management and Regional Power Trade programs are still on-going. The Regional Power Trade project is developing a power trading structure to improve basin power supplies and reduce costs. It works to achieve its' objective by facilitating power trade among the Nile basin countries and providing a comprehensive basin-wide analysis of long-term power supply, demand, and power trade opportunities, as a foundation for planning multi-purpose river basin management in the subsidiary action plans of the NBI.[29] Working with all members of the NBI this project will identify where hydroelectric projects can provide needed electricity with acceptable environmental impacts.

The foundation of the water resource management program for members of the Nile Basin Initiative is for each nation to develop and implement an Integrated Water Resources Management (IWRM) Plan. IWRM is defined by Global Water Partnership as "a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems".[30] From an engineering perspective, IWRM maximizes the use of available water resources through four efficiencies. Technical efficiency, productive efficiency, product choice efficiency, and allocative efficiency all contribute to making best use of the available water.[31]

Technical efficiency can refer to water as output, such as a water reservoir or a well, or water as input such as water-use efficiency in agriculture, water recycling or reusing water. Productive efficiency involves getting the largest output of water produced for the lowest total cost.[32] This efficiency balances the cost of producing more water to the value ($) of the additional water produced. Productive efficiencies can be on the output side or the input side of the equation. For example, growing more of a specific crop with the same amount of water or it may be more cost effective to store water in an aquifer than to build a water storage tank. Product-choice efficiency means that goods and services reflect a consumer's preference and willingness to pay.[33] When possible, water industries should allow their customers to have input on matters of quality and service of their water in exchange for specified payments. Allocative efficiency refers to how water is allocated between competing uses such as domestic, commercial, agricultural, and environmental.[34]

These are ways to improve water efficiencies. Creating or improving water infrastructure while taking the costs and benefits of this construction into account. Decreasing the amount of water actually used by a farmer's crops allows for more crops to be grown with the same amount of water. Regular maintenance of water infrastructure can be more cost effective than waiting until it must be replaced. Encouraging appropriate water re-use and recycling can help this resource go farther. Economic incentives can be used to encourage water conservation and to pay for the infrastructure and services required to provide the water. There must be consideration of water rates to ensure that the poorest can still afford to pay to meet their basic needs. Improving allocative distribution of water may mean that the region or national policy

encourages the import of water hungry crops from other areas, in effect saving local water for other uses.

Policy makers and resource managers must consider many factors, including efficiencies, when trying to create water management and development policy. Integrated Water Resource Management helps policy makers create policy that shapes how land and water are developed and managed. Further, IWRM considers all water that we use, surface and ground water, upstream and downstream. The pressures on water as a resource include population growth creating more demand for water and producing more waste water and pollution; the growth of urban areas which increases difficulty in water delivery and waste water treatment; economic growth which is directly linked to availability of clean water; climate variability and change which brings increased uncertainty about weather patterns and creates more intense floods and droughts with the destruction that these bring.[35]

Integrated Water Resource Management uses these efficiencies and creates an integrated synthesis of information from water users (consumer, agriculture, commercial), water managers, and local, national, and international laws. Including the stakeholders is important to developing a management plan that meets the needs of the water consumers and aids in developing buy-in. The development of the IWRM plan establishes needed regulatory agencies and laws. During the phased start of the IWRM the following occur: public education and information events about the plan, monitoring for compliance, enforcing mechanisms, inspections of water consumers and management practices, and events to get public buy-in. The IWRM must also educate the water resource managers and water infrastructure operators to effectively utilize

monitoring and usage data with the decision support systems to make management decisions and allow public policy actors to establish policy. The scientific data includes, but is not limited to, information about the water available in surface and ground water annual flows or recharge rates, regional uses for the water, the economics of the region, and water consumption and distribution patterns. This data is used to help inform policy development and create decisions support systems which provide a systematic and informed way to make decisions about water resources. Political leaders, government agencies, industry, and the general public help form the public policy for a region or nation's water.

The policy creation is started by considering the goals and driving forces behind the IWRM plan. Analysis of water management options, needs, conflicts, trends, current policies, public acceptance, and political will set the environment for policy creation. Within these factors and legal, regulatory, and institutional frameworks, the IWRM policy is created, along with a plan, delegation of authority, and timetable to enact the plan. During the formation of the IWRM, laws, regulations, judicial review, and the creation of any organizations needed to implement the plan occur. When the plan is implemented communication and education of the IWRM processes and procedures is crucial. IWRM constantly monitors how well the system meets user needs and periodically the plan should be adjusted to ensure the system(s) are sustainable and provide the best distribution possible of the available water.

IWRM includes both hard and soft components. It includes the infrastructure needed to harness water for productive use and protect from droughts and floods. It creates the institutions and management interventions needed to ensure its efficient

use. It safeguards the resource and the ecosystems that depend on it. Finally, it mediates between competing users and uses. The basin level water management is preferred because watersheds do not stop at international boundaries but rather function within hydrological boundaries.

Water Laws, Conventions, Treaties, and Regulation

To prevent potential conflict and resolve existing disputes, the international community has focused considerable attention in the second half of the 20th century on developing and refining principles of international freshwater management. It is worth noting that in customary international water disputes, the most frequent complaint is one nation changing the amount of water available to another nation or polluting the water making it less useful or unusable. There are three professional international organizations, the Institute of International Law, the International Law Association, and the UN International Law Commission, that have been instrumental in compiling customary international law as it applies to water.

The Institute of International Law (Institut de Droit International) passed three important resolutions. The 1911 Madrid Declaration on the International Regulation regarding the Use of International Watercourses discourages unilateral basin (watershed) alterations and harmful modifications of international rivers and advocates the creation of joint water commissions.[36] The Institute further expanded on the Madrid Declaration in 1961. The 1961 Salzburg Resolution on the use of International Non-Maritime Waters stated that, “one State’s right to make use of a shared water resource is limited by the right of use by other States concerned with that same river or watershed”.[37] Any disputes over water allocation are settled on a basis of equity, taking into account the respective needs of each State and other relevant circumstances. The

Salzburg Resolution goes on to provide advanced notice of new water uses by any State and for negotiations should any State object to the new water uses. Finally, the 1979 Athens Resolution declares that States must ensure that activities within their borders do not pollute the waters of international rivers or lakes beyond their boundaries. Later in the resolution, the prohibition against pollution is modified to say that a State may cause no new or additional pollution and must abate existing pollution as soon as is practicable.[38] The Athens resolution also contains details on data exchange, prior notification of pollution, and it directs the establishment of a commission to monitor basin-wide pollution.

The second international organization, the International Law Association, developed the Helsinki Rules of 1966 on the Uses of the Waters of International Rivers. The Helsinki Rules provides that states are entitled, “to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin.” Along with this principal of sharing, is the commitment not to cause “substantial injury” to co-riparian states.[39]

In 1970, the United Nations commissioned its own legal advisory body, the International Law Commission (ILC) to codify into law the non-navigational uses of international watercourses. The ILC’s task was completed in 1997, with the United Nations General Assembly’s adoption of the Convention on the Law of the Non-Navigational Uses of International Watercourses (UN Convention).[40] The convention reinforced the Helsinki Rules and it regularized principles of “equitable and reasonable utilization” and the “obligation not to cause significant harm”. It also established a framework for the exchange of data and information, the protection and preservation of

shared water bodies, the creation of joint management mechanisms, and the settlement of disputes.[41] While the convention was adopted in 1997, to become in force it needs 35 member countries to ratify it. As of August 2010, twenty-two nations have ratified the convention. [42] The African nations that ratified the treaty include Guinea-Bissau, Libyan Arab Jamahiriya (Libya), Namibia, Nigeria, South Africa, and Tunisia.

During the time between when the Convention was initiated and adopted, the UN Economic Commission for Europe (UNECE) signed and brought into force in 1996, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes. The UNECE convention targeted reducing pollution of shared water resources so that current generations do not impact future generations' ability to use current water sources[43]. Of importance, while this 1996 convention applies only to European countries and the 1997 convention is not yet in force, international courts are using these conventions as legal president when working to resolve international water disputes especially when quantity and/or quality of water is an issue.

As national governments work to establish policies to develop and manage lands and water use for that land, use of Integrated Water Resource Management is the preferred method of crafting a policy that maximizes use of the available water within market constraints for sustainable use. Further, due to its cyclical nature, IWRM adjusts as water sources and uses change over time. A country's population density (people living in urban areas) and growth rate can create stresses on the water policy as they may create the need for costly new water infrastructure and stress the region's ability to provide the needed water and treat the generated waste water. Numerous studies have also linked the availability of sufficient clean water to an area's economic potential.

Countries that have a very low per capita Gross Domestic Product rate have difficulty developing the infrastructure needed to sustain large urban areas. Cities create higher paying jobs and therefore act as economic engines within a nation. The rule of law is very strong within most countries, which allows for regulation of land and water development and use. International law presently does not provide the same level of regulation or dispute resolution that national leaders demand to safeguard national interests. The international resolutions on the use of non-navigational waters provide a common law between nations on how water is used and managed. These resolutions are not as strong or easily enforced as national laws. The strongest means of securing an agreement between two countries is through a treaty. Therefore, it is not surprising that Egypt and Sudan, both of whom rely heavily on water originating outside of their own borders, seek to control the upstream waters through treaties. If the treaties fail to maintain desired policy choices, Egypt and/or Sudan could resort to economic or informational means to try to influence the belligerent nation. In national policy terms, the Nile's water is considered a survival interest to both Sudan and Egypt because of its importance for their economic and physical survival. This makes water one of the national interests they are likely to go to war over.

The steps taken during the creation of the Nile Basin Initiative (NBI) worked to engender trust between the nations within the basin. These steps also helped to educate and inform policy makers, water managers, and water users on how to best manage, develop, and establish policy on the use of this limited resource. International organizations such as The United Nations Educational, Scientific and Cultural Organization, Food and Agriculture Organization of The United Nations, and The World

Bank are helping member states evaluate hydropower and irrigation proposals. Integrated Water Resource Management plans in concert with decision support templates help to guide comprehansive management of the river. The integrated cyclical approach to policy formulation and management provides the best means of creating water usage and management policy that promotes sustainable economic growth and regional stability. An important part of watershed management between nations is building trust through the open sharing of flow station data between all members of the NBI. The transparency created by this data sharing helps build confidence that each nation is being honest in how they are using and managing the water passing through their territory. It helps ensure that nations abide by the treaties that they have ratified.

Because all of the surface and ground water within a watershed is physically connected, creating a water policy/management/usage group based upon the hydrologic unit of the watershed is quite logical and follows international water conventions. The water use of one nation is likely to affect the water available to other nations. One last key part of the successful resource management for NBI is an established dispute resolution procedure. Having an established dispute resolution process helps to build and maintain member's trust. It provides a peaceful mechanism to resolve disagreements through negotiation and mediation, instead of resorting to threats of violence.

While it is unlikely that any nations will declare war with another nation over a shared water resource, it is likely that tensions between nations will occur when one nation affects the quantity or quality of that shared water resource. In cases where

water rights have previously been disputed, there is a predisposition for distrust and an unwillingness to negotiate. Any planned projects that will impact the quantity or quality of an international water resource will cause diplomatic friction. That friction can be reduced to an acceptable level through dialogue between riparian nations on the details of the project and how any negative impacts have been calculated along with a plan to reduce those impacts. Shira Yoffee conducted a thorough statistical analysis of 1831 shared water resource events that occurred between 1948-1999 in 122 different river basins. After qualifying those events, she found that 67% of events over shared water resources were cooperative. Only 28% of events were conflictive and none of those events resulted in a formal declaration of war. Her analysis concluded that there is a slight association between conflict over freshwater resources and high population density, low per capita GDP, and overall unfriendly relations between countries.[44] The highest correlation between shared water resources and conflict happened where rapid or extreme changes occurred to the physical body of water such as the construction of a dam or changes to how riparian nations make policy, management, and usage decisions within the basin due to the creation of an international organization or multilateral agreement.[45]

Summary

One of the most effective methods of helping to stabilize developing nations politically and economically is to help them create a system to provide water for their citizens. Ensuring that this basic personal survival need is met is critical to the continued economic growth of these nations. Due to the interconnectedness of all water resources within the Nile River Basin, an international basin-wide approach is the best way to create and harmonize basin and national policies and water management plans. This

approach combines international water laws and conventions with bilateral or multilateral treaties, and applies the practice of integrated water resource management.

Following the Conventions on the Law of the Non-Navigational Uses of International Watercourses means that all nations along a shared water resource are entitled to make fair use of that resource for purposes including agriculture, hydropower, economic growth, and maintaining a healthy aquatic ecosystem. Each nation may not alter the quantity or quality of the water resource without compensating the other nations affected. The convention provides an established dispute resolution mechanism in the event another nation fails to abide by the treaty or water management agreement. Bilateral and multilateral treaties are legally binding between nations and should provide means of verifying compliance with the treaty as well as remedies for non-compliance. Finally, Integrated Water Resource Management offers a comprehensive method of creating a system that promotes the coordinated development and management of water, land, and related resources taking into account input from national and local leaders, scientists, water resource managers, and water users to make best and most efficient use of that shared resource.

This integrated approach ensures a dependable water supply which supports their agriculture and citizen's health translates directly into reliable food sources and improved worker productivity resulting in a greater GDP. Creating an integrated water resource management (IWRM) plan is the best way to ensure that all of a country's competing water needs are taken into account when deciding how to allocate this vital resource. To be most effective, each nation's IWRM plan must be synchronized with neighboring nations that share these same water resources.

The use of IWRM is more critical when considering climate change. The arid and semi-arid regions of Africa, with their limited coping capacity, are some of the most vulnerable regions to the impact of climate change. Changes in rainfall and more intense and widespread droughts are projected. These changes in precipitation and temperature are likely to impact crop production amounts or even viability of certain crops. The projected changes make the international management of the Nile River Basin even more important to maintaining regional stability.[46]

Current United States international policy on water is embodied in the Senator Paul Simon Water for the Poor Act of 2005. The Water Act for the Poor provides guidance and financial resources to the Department of State and United States Agency for International Development (USAID) to increase affordable and equitable access to safe drinking water and sanitation within the context of sound water resource management in developing nations. USAID works directly with developing nations and sometimes works through international organizations and financial institutions, such as the UN and The World Bank, to support water and sanitation related activities. The US takes these steps in the developing world in to promote stability through sustained economic growth, sustainable food production, and improved health.

The economies, populations, agriculture, and location between the arid and semi-arid parts of north-east Africa, along with shifting weather patterns, make the Nile River Basin of particular concern to the US and the international community. As Egypt forms its new government, the other nations within the basin need to know if that government will honor previous treaties and water usage agreements. It has been over fifty years since Egypt almost started an armed conflict with Sudan over the waters of

the Nile. The international community will continue working with Egypt and other members of the Nile River Basin to ensure that the needs of all members are considered when negotiating changes to current usage of the waters of the Nile.

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